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(71) Applicant(s)
Motorola Limited
(Incorporated in the United Kingdom)
Jays Close, Viables Industrial Estate, BASINGSTOKE, Hampshire, RG22 4PD, United Kingdom

(72) Inventor(s)
Gary Aitkenhead

(74) Agent and/or Address for Service
Marc Morgan
Motorola Limited, European Intellectual Property Operation, Midpoint, Alencon Link, BASINGSTOKE, Hampshire, RG21 7PL, United Kingdom

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GB 2287612 A WO 95/01679 A1

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(54) Abstract Title
Direct mode communication system

(57) A mobile wishing to communicate by direct mode to another mobile requests permission to do so from a central controller when registering with the system. If permission is granted, an acknowledgement is sent from the controller containing a list of frequencies the mobile may use for direct mode operation in that area. Permission may be refused on the grounds that their are no available frequencies for direct mode operation, or that the mobile is known to be stolen. Cumulative call duration data supplied by the mobile unit to the central controller may be used for billing purposes. The mobile is also capable of conventional communication via a central unit.

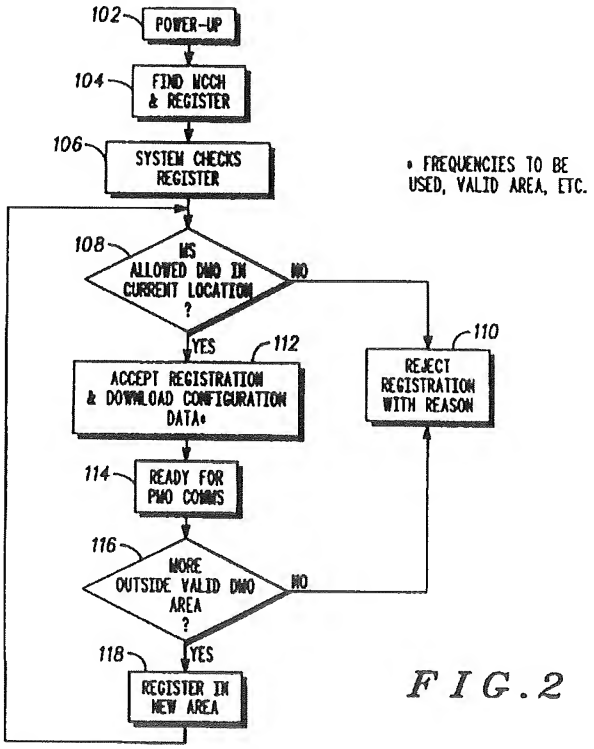

FIG.2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

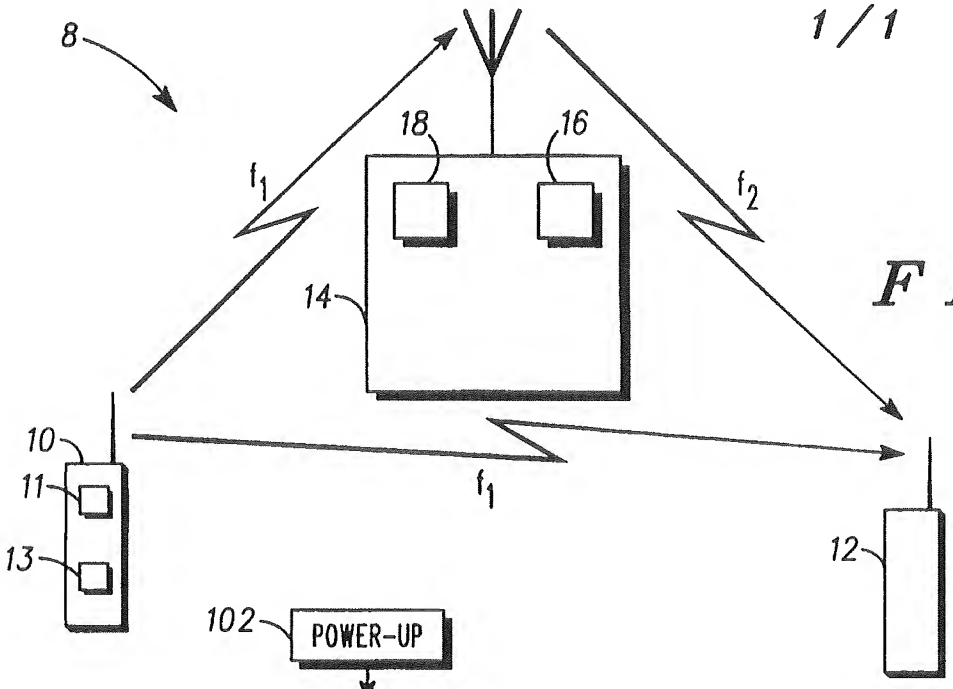
8
18
16
f_1
f_2
14
10
11
13
f_1
12

FIG.1

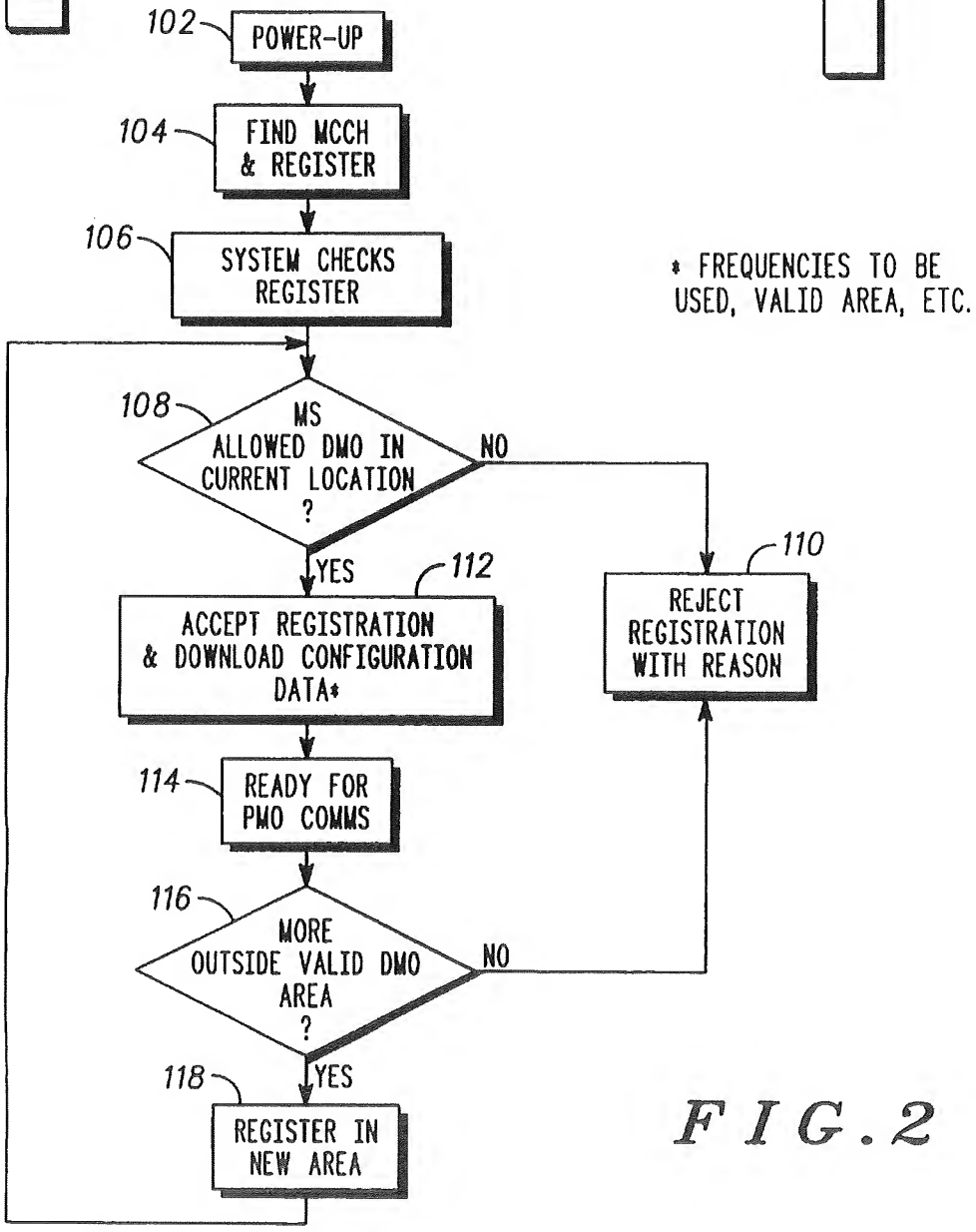
102
POWER-UP
104
FIND MCCH & REGISTER
106
SYSTEM CHECKS REGISTER
108
MS ALLOWED DMO IN CURRENT LOCATION ?
NO
YES
112
ACCEPT REGISTRATION & DOWNLOAD CONFIGURATION DATA*
110
REJECT REGISTRATION WITH REASON
114
READY FOR PMO COMMS
116
MORE OUTSIDE VALID DMO AREA ?
NO
YES
118
REGISTER IN NEW AREA
* FREQUENCIES TO BE USED, VALID AREA, ETC.

FIG.2

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RADIO COMMUNICATION SYSTEM, RADIO UNIT AND METHOD OF OPERATION

Field of the Invention

This invention relates to controlling access to radio communication systems. The invention is applicable to, but not limited to methods of allocating resources and validating requests for using such communication resources in communication systems offering more than one operating mode.

Background of the Invention

In a two way radio communication system there are often a number of communication resources, for example frequencies, time periods, coding schemes, that are available for allocating to communication system user's to enable the users to set up a communication link. In some communication systems, the radio users transmit and receive on the same radio frequency. In such a system, assuming no geographical reuse of the frequency, only one call can be established between at least two radio units at any one time. It is possible, and often implemented in multi-site systems, that the same communication resources are re-allocated on a geographical basis to some users as long as they do not interfere with existing users using that particular resource, for example where any potential interfering signal level from new users would be too low to be detected by the existing users.

In two-way radio communications systems, communication between two radios is typically performed via individual calls between two users or via group calls where users communicate to a number of other users in a particular communication group via a central controller.

Furthermore, in such communication systems, the monitoring of used talk time for a subscriber radio leads to the opportunity for the service provider to bill according to the resource usage within the

system. In a Global System for Mobile Communications (GSM), a record of phone call times is logged at the central station, as communications pass through the central station. Such recording of resource usage is subsequently used for billing purposes.

In a time division multiple access (TDMA) communication system time and frequency resources are allocated to users in trunked or non-trunked communications, for example where each frequency includes four time slots for use by four separate users. In non-trunked operation, i.e. direct mode operation (DMO) in the European TETRA standard, the radio units may communicate on a particular time slot dedicated for this mode of operation. However, there is no central element in this type of communication for either controlling voice communication or monitoring the use made of the resource by radio units.

Direct mode operation (DMO) offers an alternative communication means which does not require any fixed infrastructure to support calls between two or more mobile radios. DMO is useful where there is no fixed infrastructure or where the communication is between radios in the same locality such that base station repeaters and switching is not required. Therefore, DMO is also useful within the coverage area of a trunked infrastructure and, in fact, many trunked radios which normally use the infrastructure for communication will also be equipped with a DMO capability.

This invention proposes a method to solve an often-cited problem relating to DMO. The problem is the control of accessing DMO frequencies, particularly inside the area of coverage of the trunked infrastructure. Efficient use of frequencies drives a need to be able to use trunked frequencies for DMO in areas where the trunking infrastructure is not actually using these frequencies. Since trunked frequencies are re-used throughout a system, DMO cannot use the same trunked frequencies everywhere in the system or else this would interfere with radio transmissions of trunked radios communicating with the infrastructure. Since a radio in DMO does not know which frequencies are being used by the

infrastructure in the current area, some means is needed to inform the radio of this information.

As there is no central control of DMO frequencies, an operator cannot typically charge for the use of DMO frequencies. For trunked operation, registration is necessary before any access to communication services is allowed. This provides a gate for the operator to deny access to any subscriber who has not paid for the service. Such control is not possible in DMO meaning that operators cannot control access to DMO and charge for its use.

A further disadvantage of not having a central control for DMO resources is that communication resources are not intelligently allocated, for example, according to or by geographic areas.

Co-pending UK Patent Application No. 9623486.9 describes a method of operation of a communication system whereby a central unit operating in a trunked communication system allocates direct mode frequencies to remote units under emergency conditions. The method is described with reference to an emergency incident. The nature of the incident is such that the police, ambulance and fire services should be able to communicate in direct mode whilst travelling to the emergency. The incident is reported to a central controller and the local cell, within which the incident is located, is identified. Neighbouring, so-called "hot cells" are identified, which are the cells neighbouring the incident cell as well as the incident cell itself.

A list of direct mode configurations is then referred to for each of the groups that are to communicate in this case police, fire and ambulance. The controller then establishes a super group configuration including a channel (or channels) and a super group identifier. When a mobile enters a cell served by a base-site, that is to say a "hot cell" it will establish contact. The group identifier of the mobile will be examined by the base-site. Consideration is given as to whether or not the mobile is one of the groups allocated to the super group. This is done by the group being compared with the look up table of hot cell configurations. If the mobile is one of the groups, that is to say, a police, fire or ambulance radio it will be down loaded with the configuration of the super group from the base-site.

Thus, it will now be appreciated that as a mobile travels to an incident it will pass through neighbouring cells to the cell within which

the incident is located. Upon entry of these hot cells, the mobile will be automatically loaded with an emergency direct mode configuration (or other mode configuration) enabling communication in direct mode with members of a newly defined talk group when direct mode is selected. Since the configuration is downloaded during transit through a neighbouring cell the configuration will be available for immediate use when the mobile is at the location of the incident.

However, co-pending UK patent application no. 9623486.9 only addresses the allocation of groups to use DMO frequencies in emergency situations where communications need to be maintained whilst travelling to the emergency. Furthermore, in dual trunked-direct mode operations, fixed frequencies are allocated for the individual operating modes. These frequencies are likely to be in the same band and consequently simultaneous direct mode and trunked transmissions in the same area may interfere with each other. Also, there is no system of controlling access to direct mode frequencies based upon the authorisation status of the radio.

This invention seeks to provide a radio communication system, a radio unit for use in the radio communication system and a method of operating the radio communication system which mitigate at least some of the above mentioned disadvantages.

Summary of the Invention

According to a first aspect of the invention there is provided a radio communication system. The radio communication system supports at least two operating modes, a first operating mode enabling radio units to communicate on a first communication resource via a central controller and a second mode enabling radio units to communicate directly on a second communication resource, the radio communication system comprising a central controller which controls access to the second communication resource for use by radio units operating on the radio communication system. In this manner, the central controller controls access to, and use of, the direct mode communication resource. The direct mode communication resource is

therefore dynamically allocated in a controlled manner, according to the needs of the users in one or both operating modes.

In the preferred embodiment of the invention, the radio communication system a first radio unit transmits a registration request to the central controller and is allocated a second communication resource by the central controller in response to the registration request. On receipt of a registration request, the central controller performs a registration authorisation check on the first radio unit to determine whether a second communication resource should be allocated in response to the registration. Preferably, the radio communication system includes a plurality of communication cells and the first radio unit attempts to register on the communication system in a first communication cell and the central controller performs the registration authorisation check to determine whether the first radio unit is permitted to use the second communication resource within the first communication cell.

In this manner, access to the second communication resource is made upon a valid registration request to the central controller resulting in dynamic allocation of the direct mode resource in a controlled and regulated manner, according to the needs of the users in one or both operating modes.

Preferably, the radio communication system controls access to the second communication resource by allocating a list of available communication channels to the first radio unit, each channel having an associated channel number, the first radio unit then able to select a preferred channel. The list of available communication channels includes availability of resources in a plurality of communication cells, the first radio unit able to select a preferred channel for its future communication needs.

In this manner the user has a variety of resource options and can select a particular resource that offers the best service at that time in that location.

In a further preferred embodiment of the invention, the central controller allocates at least one channel to the first radio unit dependent upon its location, thereby either establishing a location dependent

talkgroup upon registration and thereafter the talkgroup remains independent of location; membership of the group is dynamic where additional radios are included in the talkgroup; or the talkgroup follows the location of the first radio unit.

In this manner, a dynamic talkgroup can be rapidly established and the talkgroup remains fixed at a particular location or moves with the radio unit initiating the talkgroup. Such flexibility is particularly advantageous dependent upon the real-life needs of the radio units operating on limited communication resources.

In a yet further embodiment of the present invention, the central controller includes a central billing unit for determining an accumulated call charge of the first radio unit based on the first radio's use of the second communication resource, once the first radio unit has made a valid registration on the communication system. Preferably, the first radio unit includes a timer for monitoring the period of use of the second communication resource by the first radio unit, the registration request including an accumulated usage time provided by the timer and wherein the central billing unit transmits a timer reset message to the first radio unit as part of the registration acceptance.

In the preferred embodiment of the invention, a registration request is refused by the central controller based on one of the following: the first radio unit is not provisioned for use in the respective communication cell; the first radio unit is known to be stolen or has had a call bar imposed on it; there are no second communication resources available in the respective communication cell; the number of second communication resource users exceeds a threshold level; the first radio unit has exceeded a usage threshold for operation on the second communication resource; and the first radio unit not being a valid user based on a failure to settle a previous billing account.

Preferably, the radio communication system selectively enables access to either the first communication resource or the second communication resource of the first radio unit, based on resource loading within the communication system where the registration request is for service in either the first and/or second mode of operation.

In a second aspect of the present invention a radio unit for use in a radio communication system, as hereinbefore described, is provided.

In a third aspect of the present invention a method of operating a radio communication system, as hereinbefore described, is provided.

A preferred embodiment of the invention will now be described by way of example only, with reference to the drawings.

Brief Description of the Drawings

FIG. 1 shows a communication system according to a preferred embodiment of the invention.

FIG. 2 is a flow chart showing a method of operating at least one first radio unit in the communication system according to a preferred embodiment of the invention.

Detailed Description of the Drawings

FIG. 1 shows a block diagram of a radio communications system 8 having a central controller or base station 14, primarily used for trunked communications.

The central controller 14 includes a processor 16 that maintains a list of valid mobile or portable radio registrations, to determine whether particular mobile or portable radios can validly use the communications system when attempting to register. The central controller further includes a central billing unit 18 for determining a variety of billing related information for each mobile or portable radio.

The radio communications system 8 of FIG. 1 also includes a first mobile station 10 and a second mobile station 12 capable of communicating in trunked mode or direct mode. The first mobile station 10 is shown having a processor 11 that maintains a list of time usage of the first mobile station 10 when using, for example, a direct mode communications resource. In trunked mode communications, the mobile stations communicate to each other via the base station. In practice, the transmitting first mobile station 10 transmits a signal on a

first frequency, uplink, to the base station which then communicates the signal on a second frequency, downlink, to the receiving radio, downlink. In direct mode, the mobile stations may communicate directly to each other without communicating via the base station.

In operation, the infrastructure or central controller of the trunked communications system controls the use of frequencies for DMO as well as access to DMO services within the coverage area of the infrastructure, in addition to its typical trunked mode service provision. Preferably, a radio has to first register with the infrastructure and receive permission (via positive acknowledgement to registration) to use DMO within the area covered by the current cell or location area. The acknowledgement preferably also contains a list of DMO frequencies which can be used within this area or, alternatively, the system broadcasts the DMO frequency information using, for example, a short data service as available in the Trans.-European Trunked Radio (TETRA) standard.

Having received a positive acknowledgement and a list of DMO frequencies, the radio then allows the user to select DMO mode and use those frequencies allocated for communication. Other users within the local area will also receive the same set of frequencies and so local communication between these users is possible. If a negative acknowledgement is received or no DMO frequencies can be used in the current area, DMO mode cannot be selected by the radio user. In this way, the operator can provision users for use of DMO and also control which frequencies are allocated within a specific area so as not to cause interference to trunked system users. As the radios move around the system in DMO mode, they must periodically monitor the trunked control channel to ensure that they have not strayed outside the area for which the DMO frequencies are valid. If they have, then they must listen to the main control channel for a subsequent broadcast of DMO frequencies and update the DMO configurations / frequency list in the radio.

Hence, on power-up, and regardless of mode selection (trunked or DMO), the radio searches for the main control channel of the trunked system and registers with the system. The registration request indicates whether or not the radio is in DMO mode, trunked mode or dual mode (i.e. simultaneous trunked and

DMO mode). If the radio is in DMO mode, then the registration indicates the radio is requesting only DMO service and the system does not enter that radio into the mobility database but simply checks whether or not that subscriber is provisioned for DMO in the area it is currently located. The infrastructure sends a positive or negative acknowledgement depending on the outcome of the provisioning check.

If the radio receives a negative acknowledgement, DMO mode cannot be selected by the user for that particular area. Note that DMO mode may not be available for a number of reasons, for example:

(a) the subscriber is not provisioned for DMO service in the current area or cell;

(b) the radio unit is known to be stolen or has had a call bar imposed on it;

(c) there are no frequencies available for DMO operation in the current area; or

(d) the system already has too many DMO subscribers registered for DMO service in the current area and so disallows access to prevent overloading the limited DMO traffic-capacity.

In the preferred embodiment of the invention, should the radio receive a positive acknowledgement, then the list of frequencies is delivered as part of the registration and stored in the MS so that different channels can be selected by the user in DMO mode. The registration message also contains the area within which DMO operation is allowed; this, too, is stored by the radio. If the list is not delivered as part of the acknowledgement, the radio listens to the main control channel for a short data message broadcast which reports the frequencies to be used in this area. In both cases, the frequency list indicates the area for which the frequencies are valid (e.g. by giving a list of location areas and / or cell identifiers) as well as the area for which the radio is allowed to use DMO operation. Note that the area of use may even be outside of the trunked infrastructure coverage area, the radio determines current location, not by listening to fixed infrastructure broadcasts, but by a separate location determination device (e.g. Global Positioning System receiver). Alternatively, the area of use may be

indicated as being that not inside the trunked system coverage area. This area of applicability may be generic for all DMO radios, or it may be different for each user group on the system.

Note that the DMO frequency information may be delivered along with a positive acknowledgement to the registration request, even if the registration request indicated that the radio is in trunked mode. In this case, the DMO frequency information is stored by the radio for later use, should the radio user subsequently select DMO mode.

As the radio moves around the system in DMO mode, it periodically listens to the main control channel and decodes the current location area and cell identifier to check that the DMO frequencies are still valid. If the radio recognises that it has moved out of the DMO area for which it has valid frequencies, it then looks at main control channel to decode the broadcast message giving the frequencies for the new area. If the radio has moved out of the area for which DMO operation is valid (as indicated in the DMO registration described above), the radio must register in the new area for DMO operation to see if it is still allowed to use this mode.

In a further preferred embodiment of the invention the radio unit matches a frequency to a DMO channel. The information downloaded from the infrastructure contains a DMO channel number along with each frequency. This channel number corresponds to the channel number selector at the radio user interface for DMO operation. This allows the users working in the same locality to agree on a channel number to use which ensures that they all select the same frequency for communications. Preferably, scanning receivers are used to allow receiving radios to scan all of the DMO frequencies in use in an area meaning that the transmitting party can select any channel which is not currently being used.

In a yet further preferred embodiment of the invention the subscription and provisioning control is improved upon. As described above, the radio can be allowed or denied access to DMO services by first registering with the infrastructure. This would

allow an operator to charge on, for example, a monthly basis using a flat fee for access to the DMO service. An operator may wish to bill based upon actual air time usage. This aspect of the invention proposes that the radio accumulates the actual air time used by this subscriber (for example, by just storing the total amount of air time usage) and then reporting this information to the infrastructure on each registration. Subscribers will generally power-off and power-up radios from time to time or use of periodic registration from the radio could be used. Therefore, on each DMO registration, the accumulated DMO air time is reported to the infrastructure and then on a positive acknowledgement, the air time counter is reset in the radio. This information is stored in non-volatile memory so that powering off the radio does not cause the information to be lost.

It is within the contemplation of the invention that each mobile/portable radio unit monitors at information relating to its use on the direct mode communications resource, for example, other party calling ID, day/date, call start time, call end time, call duration, duration of transmissions by that particular mobile/portable radio unit, total duration of a number of calls by that particular mobile/portable radio unit.

An over-the-air transmission download of time usage from the radio unit to the central billing unit in the communications system, is implemented whenever the communication system is lightly loaded with regard to traffic communication and the radio unit is within communication range of the fixed unit. This invention also offers the service provider to charge different rates for usage of the communication resource during different time periods or say, on week-ends. Such an opportunity to bill, and bill at different rates, greatly assists the service provider in regulating and controlling the use of the resource.

It is also within the contemplation of the invention that the service provider may provide one allocated receiver (portable, mobile or base station) to each communication resource, e.g. frequency, for logging all of the voice communications on that particular frequency. This could include recording the time periods that particular users utilise that frequency, by way of using their call ID.

Preferably, the radio unit also includes a processor 11, that provides a time stamp associated with each communication and a global positioning system (GPS) receiver. The GPS receiver is used to more accurately indicate to the radio unit and the central controller (by location transmissions from the radio unit) the exact cell or communication area the radio unit wishes to have a communication resource assigned in. Such accurate knowledge of the radio unit's position enables the central controller to better use the available resources, either trunked or direct-mode resources, to match the radio unit's particular needs.

In the preferred embodiment of the invention, the radio communication system 8 has a plurality of communication resources including radio frequencies f1 and f2, each having respective time slots (not shown) arranged in a Time Division Multiple Access (TDMA) manner. However, it is within the contemplation of the invention that other communication schemes, such as Frequency Division Multiple Access (FDMA) or Code Division Multiple Access (CDMA) would also benefit from the present invention.

In private mobile radio scenarios where talkgroups of users are set up, particularly in emergency situations, the use of accurate location information is highly advantageous. Location dependent talkgroup assignments are then performed by the central controller for trunked and/or direct mode communications, based on the communication resources required for the requested communication. A talkgroup can be established when the radios register on the system within a particular area, at the time of the request. In such a situation, the talkgroup membership could be arranged to be established immediately and thereafter to be independent of location. In this case, the location talkgroup assignment is a useful means to rapidly establish a dynamic talkgroup in the field.

Alternatively, the membership of the group can dynamically change as radios move in and out of the designated service area defined at the registration time. This ensures that new arrivals at, for example, an incident scene, are included in the location dependent talkgroup.

A yet further alternative, particularly for a direct mode operational mode request, is where the instigator of the talkgroup moves

from the location where the talkgroup was established. As the owner moves, the membership of the talkgroup is dynamically updated to only include those radio units inside an area described by a given radius from the talkgroup owner.

Referring now to FIG. 2, a method for operating the radio communications system 8 is provided. In the preferred embodiment, the communication system is a Time Division Multiple Access (TDMA) communication system, having a number of frequency channels, wherein each radio frequency is divided into four time-slots. The method of operating a radio unit in a two way radio communication system includes powering up a radio unit, as in step 102. The main control channel (MCCH) is located and the radio unit attempts to register on the radio communications system, as shown in step 104. The radio communication system then checks the valid list of authorised users on the system, as in step 106. If the radio unit is a valid authorised user of direct mode resources in the designated area, as in step 108, the radio communications system accepts the registration request and downloads direct mode configuration data to the radio unit, as shown in step 112. If the radio unit is not a valid authorised user of direct mode resources in the designated area in step 108, the radio communications system rejects the registration request, as shown in step 110. The radio unit is then allowed to operate in direct mode communications, within the designated area, as shown in step 114.

Preferably, the radio unit monitors the time operating on the direct mode communication resource and stores relevant information. The stored information may include at least one of: details of the other party's calling ID, day, date, call start time, call duration, call end time, total call time. Should the radio unit move out of the designated area, as shown in step 116, the system checks to see whether the radio unit is a valid user in the area moved into. If the radio unit is a valid user in step 116, the radio unit registers in this new area, as in step 118, and the process repeats from step 108. If the radio unit is not a valid user in step 116, the radio unit fails to register in this new area, as shown in step 110.

Once the call is terminated, the radio preferably checks to see whether it is connected to, or within range of a fixed infrastructure. If it is within range of the infrastructure, the radio unit may transmit the stored information to a fixed central unit for determining the call charge

rate to be billed to the radio unit. Alternatively, the radio unit may accumulate the total call charge for all DMO calls and transmit the stored information to the central unit the next time it registers. Such a mechanism is also used when the radio unit makes DMO calls while outside the coverage area of the fixed infrastructure.

In this manner, a two way communication system, a method of operating the two way communication system and a radio unit for use in the two-way communication system are provided which mitigate at least some of the aforementioned disadvantages with present communications systems.

Claims

1. A radio communication system supporting at least two operating modes, a first operating mode enabling radio units to communicate on a first communication resource via a central unit and a second mode enabling radio units to communicate directly on a second communication resource, the radio communication system comprising a central controller which controls access to the second communication resource for use by radio units operating on the radio communication system.

2. A radio communication system according to claim 1 wherein the radio communications system includes the central controller and a first radio unit transmits a registration request to the central controller and is allocated a second communication resource by the central controller in response to the registration request.

3. A radio communication system according to claim 1 or 2 wherein the central controller performs a registration authorisation check on the first radio unit to determine whether a second communication resource should be allocated in response to the registration.

4. A radio communication system according to claim 3 wherein the radio communication system includes a plurality of communication cells, the first radio unit attempts to register on the communication system in a first communication cell and the central controller performs the registration authorisation check to determine whether the first radio unit is permitted to use the second communication resource within the first communication cell.

5. A radio communication system according to any one of the preceding claims, wherein the radio communication system controls access to the second communication resource by allocating a list of available communication channels to the first radio unit, each channel having an associated channel number, the first radio unit then able to select a preferred channel.

6. A radio communication system according to claim 5, wherein the list of available communication channels includes availability of resources in a plurality of communication cells, the first radio unit able to select a preferred channel for its future communication needs.

7. A radio communication system according to any one of preceding claims 1 to 5, wherein the radio communication system controls access to the second communication resource by allocating at least one channel to the first radio unit dependent upon its location.

8 A radio communication system according to claim 7, wherein the location dependent talkgroup is at least one of the following:

established upon registration and thereafter the talkgroup remains independent of location;

membership of the group is dynamic where additional radios are included in the talkgroup; or

talkgroup follows the location of the first radio unit.

9. A radio communication system according to any one of the preceding claims, wherein the central controller includes a central billing unit for determining an accumulated call charge of the first radio unit based on the first radio's use of the second communication resource, once the first radio unit has made a valid registration on the communication system.

10. A radio communication system according to claim 9, wherein the first radio unit includes a timer for monitoring the period of use of the second communication resource by the first radio unit, the registration request including an accumulated usage time provided by the timer and wherein the central billing unit transmits a timer reset message to the first radio unit as part of the registration acceptance.

11. A radio communication system according to any one of preceding claims 2 to 10, wherein a registration request is refused by the central controller based on at least one of the following:

the first radio unit is not provisioned for use in the respective communication cell;

the first radio unit is known to be stolen or has had a call bar imposed on it;

there are no second communication resources available in the respective communication cell;

the number of second communication resource users exceeds a threshold level;

the first radio unit has exceeded a usage threshold for operation on the second communication resource; and

the first radio unit not being a valid user based on a failure to settle a previous billing account.

12. A radio communication system according to any one of the preceding claims, wherein the radio communication system selectively enables access to either the first communication resource or the second communication resource of the first radio unit, based on resource loading within the communication system.

13. A radio communication system according to claim 12 wherein the registration request is for service in either the first and/or second mode of operation.

14. A radio unit for use in a radio communication system according to any one of the preceding claims.

15. A radio unit according to claim 14 wherein the radio unit includes a processor for maintaining a list of time usage of the at least one communication resource.

16. A radio unit according to any one of preceding claims 14 to 15 wherein the maintained list of the radio unit includes at least one of: other party calling ID, day, date, call start time, call duration, call end time, total call time.

17. A radio unit according to any one of preceding claims 14 to 16 wherein the radio unit further comprises a transmitter to transmit the maintained list to a central billing unit for determining the accumulated call charge of the at least one first radio unit.

18. A method of operating a radio communication system supporting at least two operating modes, comprising the steps of:

operating a first mode enabling radio units to communicate on a first communication resource via a central unit;

operating a second mode enabling radio units to communicate directly on a second communication resource; and

controlling access to the second communication resource for use by radio units operating on the radio communication system.

19. A method of operating a radio communication system according to claim 18 wherein the radio communications system includes a central controller and a first radio unit, the method further comprising the steps of:

transmitting a registration request to the central controller by the first radio unit; and

allocating a second communication resource by the central controller in response to the registration request.

20. A method of operating a radio communication system according to claim 19, further comprising the step of:

performing a registration authorisation check on the first radio unit by the central controller to determine whether a second communication resource should be allocated in response to the registration request.

21. A method of operating a radio communication system according to claim 20 wherein the radio communication system includes a plurality of communication cells and the first radio unit attempts to register on the communication system in a first communication cell, the central controller performing the registration authorisation check to determine whether the first radio unit is permitted to use the second communication resource within the first communication cell.

22. A method of operating a radio communication system according to any one of preceding claims 18 to 21, wherein the step of controlling access to the second communication resource includes allocating a list of available communication channels to the first radio unit, each channel having an associated channel number, the first radio unit then able to select a preferred channel.

23. A method of operating a radio communication system according to any one of preceding claims 18 to 22, wherein the central controller includes a central billing unit, the method further comprising the steps of:

determining an accumulated call charge of the first radio unit based on the first radio's use of the second communication resource, whereby the first radio unit has recorded usage information of the second communication resource used by the first radio unit.

24. A method of operating a radio communication system according to claim 23, the method further comprising the step of:

maintaining a list of time usage of the at least one communication resources, the maintained list including at least one of: other party calling ID, day, date, call start time, call duration, call end time and total call time.

25. A communication system substantially as hereinbefore described with reference to, or as illustrated by, FIG. 1 of the drawings.

26. A method of operating a communication system substantially as hereinbefore described with reference to, or as illustrated by, FIG. 2 of the drawings.

The Patent Office

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Databases searched:

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Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X, E	GB 2319436 A	(MOTOROLA) see page 5 line 29 to page 6 line 8	1, 7, 14, 18
X	GB 2308956 A	(NOKIA) see page 16 line 16 to page 18 line 11	1, 14, 18
X	GB 2295944 A	(SONY) see abstract	1, 14, 18
X	GB 2287612 A	(MOTOROLA) see figure 6	1, 14, 18
X	WO 95/01679 A1	(MOTOROLA) see page 4 line 23 to page 5 line 18	1, 14, 18

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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